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Title: IMAGE-RECORDING TRANSPARENT FILM AND IMAGED FILM

Abstract:

An image-recording transparent film comprising a light-transmitting film substrate and a light-transmitting image-receiving layer placed on at least one major surface of the film substrate, wherein said image-receiving layer contains (a) a thermoplastic resin selected from the group consisting of a polyester resin, a styrene/acrylic resin, an acrylic resin, an epoxy resin, a urethane resin and a polyolefin resin, and (b) a plasticizer which is compatible with the thermoplastic resin.

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(71) Applicant: MINNESOTA MINING AND MANUFACTURING COMPANY [US/US]; 3M Center, P.O. Box 33427, Saint Paul, MN 55133-3427 (US).

(72) Inventor: KAMIYAMA, Koji; 33-1, Tamagawaida 2-chome, Setagaya-ku, Tokyo 158 (JP).

(74) Agents: NEAVEILL, Darla, P. et al.; Minnesota Mining and Manufacturing Company, Office of Intellectual Property Counsel, P.O. Box 33427, Saint Paul, MN 55133-3427 (US).

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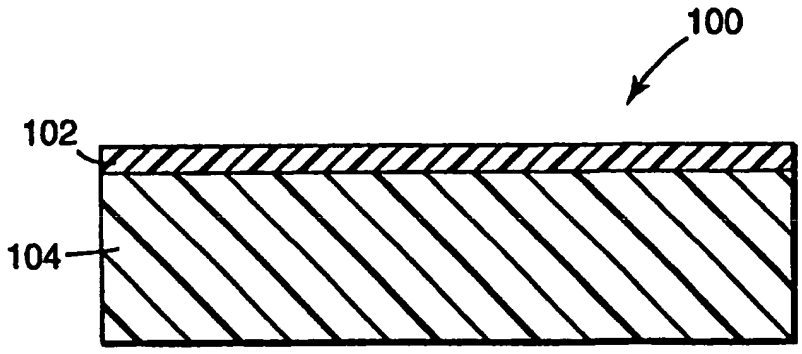

(57) Abstract

An image-recording transparent film comprising a light-transmitting film substrate and a light-transmitting image-receiving layer placed on at least one major surface of the film substrate, wherein said image-receiving layer contains (a) a thermoplastic resin selected from the group consisting of a polyester resin, a styrene/acrylic resin, an acrylic resin, an epoxy resin, a urethane resin and a polyolefin resin, and (b) a plasticizer which is compatible with the thermoplastic resin.

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IMAGE-RECORDING TRANSPARENT FILM AND IMAGED FILM

Background of the Invention

Description of the Technology

The present invention relates to an image-recording transparent film which can be imaged by an electrophotographic method, and more particularly to a transparent color image-recording transparent film for use in an overhead projector (OHP).

Related Art

The recent progress in full-color electrophotographic technology has improved images greatly, but when a color image is formed on a film by an electrophotographic method, smoothness of a toner layer after fixing tends to be somewhat unsatisfactory. When such a color image is used as an image for OHP projection, incident light scatters and a projected image on a screen becomes dark, and original color of the image is not completely reproduced.

Japanese Kokai Publication No. Sho 63-80273 discloses methods for improving smoothness of the toner layer after fixing, such as: a method of fixing at high temperatures at which toner thoroughly melts, a method of fixing by using solvents such as toluene and the like, a method of polishing an imaged surface after fixing, and a method of applying a transparent coating composition which does not dissolve toner onto a fixed toner layer. However, at the high temperatures at which the toner thoroughly melts offset occurs in the area of high density in a contact fixing method using a roller, or an image-recording transparent film waves in a non-contact heating fixing method using an oven and it takes time for fixing. In the fixing method using solvents, flow or loss of image occurs in the area of high density. In the method of polishing an imaged surface after fixing, it is impossible to thoroughly increase smoothness of the toner layer at the area of low density. In the method of applying a transparent coating which does not dissolve toner onto a fixed toner layer, a definite boundary may be formed between toner particles and a toner image, the boundary scatters light, and reproducibility of colors becomes poor.

Japanese Kokoku Publication No. Hei 6-14232 proposes a method for improving compatibility between a binder and a colorant such as dyes and pigments

which constitute toner, by contacting a plasticizer with a fixed toner layer. However, even if the compatibility between the binder and the colorant is improved, smoothness of a surface of the toner layer does not increase.

Japanese Kokai Publication No. Hei 2-263642 (corresponding to US Patent Nos. 5,009,945, 5,229,188 and 5,352,553) discloses a transparent image-recording film having an image-receiving layer on its surface containing a resin which has elasticity higher than that of a binder of toner and is compatible with the binder.

However, at the toner fixing temperature, toner does not sink sufficiently in the image-receiving layer, because the image-receiving layer is harder than the toner, and a surface of the toner layer becomes uneven.

In this transparent film, the solubility parameter of the image-receiving layer is controlled (no plasticizer is added) in order to make the image-receiving layer and the toner compatible. According to the procedure, however, an image-receiving layer have to be prepared corresponding to a kind of the toner binder used individually, and the procedure lacks versatility.

Japanese Kokai Publication No. Hei 4-212168 (corresponding to US Patent No. 5,208,211) discloses a transparent image-recording film having an image-receiving layer thereon of which fluidizing temperature is lower than that of toner.

However, the transparent film does not produce a smooth surface of a toner layer when the toner has larger particle size than thickness of the image-receiving layer or when the toner coheres.

The present invention is made in order to solve the conventional problems, and an object of the present invention is to provide an image-recording transparent film which can record a transparent image by the use of an electrophotographic recording system, wherein the transparent image has high lightness and saturation and offers good color tone reproducibility in the use for OHP.

Description of the Invention

The present invention provides an image-recording transparent film comprising a light-transmitting film substrate and a light-transmitting image-receiving layer placed on at least one major surface of the film substrate, wherein said image-receiving layer

contains (a) a thermoplastic resin selected from the group consisting of a polyester resin, a styrene/acrylic resin, an acrylic resin, an epoxy resin, an urethane resin and a polyolefin resin, and (b) a plasticizer which is compatible with the thermoplastic resin, thereby the object of the present invention is achieved.

The present invention also provides an imaged film comprising the above described image-recording transparent film and an imaging material layer which is imagewise placed on a surface of the image-receiving layer thereof.

Throughout the specification, "imaging material" means a resin composition comprising colorant such as dyes and pigments and a thermoplastic resin. The imaging material generally has a melting point of from 60 to 150°C and a mean particle size of from 3 to 50 μm, and examples include thermal transfer ink and toner for electronic copying. The imaging material is fixed to the image-recording transparent film by a fixing method such as a thermocompressing roller according to a desired pattern to form an imaging material layer on a surface of the image-receiving layer.

Figure 1 shows a cross sectional view of one embodiment of a transparent image-recording film (an image-recording transparent film) according to the present invention. An image-recording transparent film 100 is a composite film comprising a light-transmitting image-receiving layer 102 placed on a surface of a light-transmitting film substrate 101.

The image-receiving layer containing a plasticizer has a storage elasticity (G') of generally not less than 1×10^1 to 1×10^5, preferably of from 1×10^2 to 5×10^4 dyne/cm^2, more preferably from 5×10^2 to 1×10^4 dyne/cm^2 at 150°C when measured by using Rheometrics "DYNAMIC ANALYZER RDA" in a measuring temperature of from 40°C to 200°C raised in the temperature step mode, in a frequency of 6.28 rad/sec in the share mode, and using "disposable cup" having a diameter of 25 mm ∅ and a height of 5 mm as a sample holding tool.

When the storage elasticity is less than 1×10^1 dyne/cm^2, offset is liable to occur in fixing, and leveling of the imaging material layer after fixation becomes difficult, while if it is more than 1×10^5 dyne/cm^2, the imaging material becomes difficult to sink in the image-receiving layer, and a surface of the imaging material layer becomes uneven.

The image-receiving layer contains a thermoplastic resin and a plasticizer which is compatible with the thermoplastic resin. The thermoplastic resin may be selected form any resin (binder) which has been hitherto used as a material for fixing or receiving the imaging material. Preferred is the resin which has excellent compatibility with a binder used for the imaging material, which easily adhere the imaging material, and which is liable to provide a transparent image.

Thus, the thermoplastic resin is selected such that the image-receiving layer substantially consists of a polyester resin, a styrene/acrylic resin, an acrylic resin, an epoxy resin, an urethane resin, a polyolefin resin or mixtures thereof. The resin same as a binder of the imaging material is particularly preferred.

The thermoplastic resin generally has a softening point of from 40 to 180°C, more preferably, from 90 to 150°C without a plasticizer. When the softening point is less than 40°C, the image-receiving layer is liable to wear and become difficult to handle, and when it is more than 180°C, sinking of the imaging material becomes insufficient, and the imaging material layer becomes uneven. Meanwhile, the "softening point" used herein refers to a value measured by the ring and ball method.

Typically, it is possible to use a thermoplastic resin having a weight average molecular weight of from 10,000 to 150,000. If the molecular weight is excessively small, holding power to the imaging material fixed on the image-receiving layer tends to become poor, while if it is excessively large, smoothness of the imaging material layer tends to become poor.

Preferred thermoplastic resin is a polyester resin. This is because the polyester resin has high transparency, excellent compatibility with the imaging material, and good fluidity, and thereby smoothness of a surface of the imaging material layer is improved.

Preferred polyester resin is those prepared from (i) a diol component comprising a bisphenol derivative as a principal constituent and (ii) a dicarboxylic acid component selected from a group consisting of dicarboxylic acids, and acid anhydrides and lower alkyl esters thereof.

These polyesters preferred to be used for the present invention are commercially available, and examples include "PS-3" available from Kao Corp., "Atlac

363E" available from Reichhold Chemicals Company, "Atlac 382E" available from Reichhold Chemicals Company, "POLYESTER HP-3201, available from Nippon Gosei Kagaku K.K., and the like.

It is preferred that a polyester resin is used in an amount of not less than 50% by weight based on the total weight of the thermoplastic resin which composes the image-receiving layer.

The plasticizer contained in the image-receiving layer is compatible with the thermoplastic resin. The "plasticizer" of the present invention means a substance which reduces a coefficient of elasticity of the image-receiving layer without impairing its transparency, and increases lightness and saturation of an image. The image-receiving layer may contain two or more plasticizers.

Examples of the plasticizer which may be employed for the present invention include phthalates such as dimethyl phthalate, diethyl phthalate, isobutyl phthalate, dibutyl phthalate, heptyl phthalate, di-2-ethylhexyl phthalate, diisooctyl phthalate, di-n-octyl phthalate, dinonyl phthalate, isodecyl phthalate, tridecyl phthalate and dicyclohexyl phthalate; fatty acid dibasic acid esters such as diisodecyl succinate, dioctyl adipate, diisodecyl adipate, dioctyl azelate, dibutyl sebacate, dioctyl sebacate and dioctyl tetrahydrophthalate; glycol esters such as dipentaerythritol hexaester and pentaerythritol ester; phosphates such as trioctyl phosphate, octyl diphenyl phosphate, triphenyl phosphate, trichloroethyl phosphate and cresyl diphenyl phosphate; and epoxy plasticizers such as butyl epoxystearate, octyl epoxydistearate, benzyl epoxystearate and dioctyl epoxyhexahydrophthalate.

Polyalkylene oxide polyol may also be employed as the plasticizer in the present invention. The "polyalkylene oxide polyol" means generally a compound having a chain of polyalkylene oxide such as polyethylene oxide and polypropylene oxide and two or more terminal hydroxyl groups connected by the chain of polyalkylene oxide.

A molecular weight of the polyalkylene oxide polyol may be varied within the range that the polyalkylene oxide polyol is sufficiently compatible with the thermoplastic resin, without impairing its transparency. The number average molecular weight of the polyalkylene oxide polyol measured by the quantitative analysis of end

group is in the range of generally from about 100 to 2000, preferably from about 150 to 1000. If the molecular weight of the polyalkylene oxide polyol is less than 100, the polyalkylene oxide polyol may bleed out to an imaged surface, and it may soil the image. If the molecular weight is more than 2000, effects of adding the plasticizer may become poor.

As the plasticizer of the present invention, preferred polyalkylene oxide polyol includes the compounds having the following formulas.

Formula 1:

$$HO(CH_2CH_2O)_nH$$

wherein, n represents an integer of from 2 to 100.

Formula 2:

$$HO(CH_2CH_2CH_2CH_2O)_nH$$

wherein, n represents an integer of from 8 to 30.

Formula 3:

$$HO(CH(CH_3)CH_2O)_nCH_2CH(CH_3)O(CH_2CH(CH_3)O)_nH$$

wherein, n represents an integer of from 1 to 20.

Formula 4:

$$\begin{array}{l} CH_2O(CH_2CH(CH_3)O)_nH \\ | \\ CHO(CH_2CH(CH_3)O)_nH \\ | \\ CH_2O(CH_2CH(CH_3)O)_nH \end{array}$$

wherein, n represents an integer of from 1 to 20.

A compound represented by the formula 1 is generally referred to as polyethylene glycol, and includes, for example "PEG 200", "PEG 300", "PEG 400" and "PEG 600" available from Sanyo Kasei K.K. A compound represented by the formula 2 is generally referred to as polytetramethylene glycol, and includes, for example "PTMG 6501, and "PTMG 1000" available from Sanyo Kasei K.K. A compound represented by the formula 3 is generally referred to as polypropylene glycol, and includes, for example "PP 200", "PP 400" and "PP 1000" available from Sanyo Kasei K.K. A compound represented by the formula 4 is generally referred to

as polypropylene glycol glycerin triether, and includes, for example "GP 250", "GP 600" and "GP 1000" available from Sanyo Kasei K.K.

Particularly preferred plasticizer employed for the present invention is the plasticizer having at least one aromatic ring in its molecule among the above described plasticizers, such as tricresyl phosphate, diethylene glycol dibenzoate and dioctyl phthalate, and polyalkylene oxide polyol represented by the formula 1 to 4. It is preferred that the plasticizer having at least one aromatic ring in its molecule or polyalkylene oxide polyol is used in an amount of not less than 50% by weight based on the total weight of the plasticizer employed in the present invention.

The plasticizer is used for the image-receiving layer generally in an amount of about 1 to 100 parts by weight, preferably 1 to 50 parts by weight, more preferably 2 to 30 parts by weight, based on 100 parts by weight of the thermoplastic resin. When the amount of the plasticizer is less than about 1 part by weight, effects of addition become small, while if it is more than about 100 parts by weight, it becomes difficult to handle and the haze value becomes excessively large.

Although it is not clear in detail, the plasticizer sharply modify fluidity of the image-receiving layer (increases fluidity) when it is heated and pressed in fixing of toner. The plasticizer improves compatibility between a resin of the image-receiving layer and a binder of the imaging material (for example, toner). Thereby, smoothness of the imaging material layer after fixing is improved, lightness and saturation of the color image as well as color tone reproducibility of the projected image becomes excellent.

It is preferred that the image-receiving layer have a surface resistivity of 1×10^{8} to $1 \times {}^{13}\ \Omega/\square$, particularly 1×10^{9} to $1 \times {}^{12}\ \Omega/\square$. If the surface resistivity is less than $1 \times 10^{8}\ \Omega/\square$, particles of the imaging material liable to fall from the image-receiving layer. If the surface resistivity is more than $1 \times 10^{8}\ \Omega/\square$, traveling efficiency of the film becomes poor.

In order to control surface resistivity of the image-receiving layer, an antistatic agent may be contained in the image-receiving layer. Preferred antistatic agent is generally chosen from a group consisting of a nonionic antistatic agent, a cationic antistatic agent, an anionic antistatic agent and a fluoride-based antistatic agents.

Specifically, steramidolpropyldimethyl-β-hydroxyethyl ammonium nitrate, and N,N'-bis(2-hydroxymethyl)-N-(3'-dodecyloxy-2,2'-hydroxypropyl)methyl ammonium methyl nitrate, and the like.

The image-receiving layer may contain an suitable amount of other additives known to those skilled in the art. Examples thereof include an inorganic particle and a UV absorber, and the like.

Though not illustrated herein, an image-receiving layer may optionally be placed on a back surface of the film substrate. An additional layer, for example, a protective layer or an adhesive layer and the like may be placed at suitable positions, such as between the film substrate and the image-receiving layer, on the image-receiving layer and the like, with the proviso, the additional layers do not adversely effect the present invention.

The film substrate used in the present invention may be any suitable light transmitting plastic film which has conventionally been used for manufacturing an image-recording transparent film. Examples thereof include polystyrene, polyamide, polyvinyl chloride, polyester, polycarbonate, and the like. Particularly, polyethylene terephthalate is preferred in view of mechanical properties, workability, and the like. The plastic film may optionally be corona-treated or it may have a layer containing an antistatic agent, and the like, on a back surface.

The film substrate preferably has a thickness of from 10 to 200 μm, more preferably from 50 to 175 μm. If the thickness is less than 10 μm, heat resistance and mechanical strength become poor. If the thickness is more than 200 μm, light transmittance (transparency) becomes poor and handling becomes complicated.

The image-recording transparent film of the present invention can be prepared by various procedures known to those skilled in the art. One example is, by first, a film forming composition containing the components which forms the image-receiving layer and a volatile solvent is applied on the film substrate, and dried to form the image-receiving layer. Meyer bar coating, extrusion coating, dye coating, gravure coating, kiss roll coating and other general applying and laminating methods can be used.

The image-receiving layer is preferably placed in an amount of from 0.1 to 100 g/m^2. If the amount is less than 0.1 g/m^2, the resulting image-receiving layer may not thoroughly receive an imaging material, and if it is more than 100 g/m^2, light transmittance and traveling efficiency in an imaging equipment of the resulting recording film becomes poor. More preferably, the image-receiving layer is placed in an amount of from 0.5 to 10 g/m^2.

An image-recording film of the present invention has the image-receiving layer of which thickness is sufficiently reduced as compared to the conventional image-recording film of which image-receiving layer do not contain a plasticizer. Thereby, smoothness of the imaging material layer and light transmittance of the image-recording film are improved. In the preferred embodiment in which the image-receiving layer is placed in an amount of 0.5 to 10 g/m^2 after drying, a particularly excellent image is offered.

When the image-recording transparent film of the present invention is used, by first, as shown in Figure 2a, the imaging material 203 is deposited on a surface 204 of the image-receiving layer of the image-recording transparent film 200, at the area corresponding to an image to be formed. A composite comprising the imaging material 203, the image-receiving layer 202, and the film substrate 201 is then heated and pressed. As shown in Figure 2b, the imaging material is thereby fixed in the vicinity of a surface 204 of the image-receiving layer as the imaging material layer 205, and the imaged film 206 is formed.

The imaging material can be deposited and fixed to the image-recording transparent film by an electrophotographic recording system. Specifically, an electronic duplicator such as Model "CLC350" available from Canon Corp. can be used.

The imaging material layer 205 is not completely buried in the depth direction of the image-receiving layer 202 but partly buried in the image-receiving layer 202, and it slightly protrudes from the surface. The height of protrusion is as low as that quality of an image may not be impaired by scattering of light which is incident to the imaged film. A surface of the imaging material layer 205 is leveled. In addition, at the interface between the imaging material layer 205 and the image-receiving layer 202, a

binder of the imaging material layer 205 is well compatible with a thermoplastic resin of an image-receiving layer 202. It is believed that the imaged film 206 of the present invention provide a transparent image with high lightness and saturation as well as satisfactory tone reproducibility in the use for OHP, according to these features.

In order to improve tone reproducibility of an projected image in the use for OHP, lightness and saturation of an transparent image of the imaged film have to be improved. The imaged film of the present invention provides a lightness of more than 91 and a saturation of more than 27 when a yellow transparent image having an optical density of 0.26 is measured in the transmission mode with a view field of 100.

According to the present invention, high lightness and saturation which cannot be obtained with the conventional imaged film is provided. The lightness and saturation specified herein are measured by using D65 light rays as reference light with a general calorimeter. A calorimeter "COLOR ANALYZER TC-180OMKII" available from Tokyo Denshoku Co., Ltd. can specifically be employed.

Meanwhile, a black and white image may also be formed on an image-recording transparent film of the present invention by using the above described electrophotographic device, and a black and white image having excellent resolution and density is provided. That is, either a colored image or a black and white image may be formed on the present image-recording transparent film, according to an electrophotographic recording process, and an excellent image is provided in any case.

Examples:

Example 1

Table 1

Composition	Parts by Weight
Polyester resin (available from Kao Corp. as "PS-3")[1]	20.00
Polyester resin (available from Shell Chemical Co. as "VITEL 2700")[2]	0.40
Antistatic agent (available from American Cyanamid Co. as "Cyastat 609")	0.50
Silica particles (available from Fuji Silica Chemical K.K. "Silica 470")	0.03
Tricresyl phosphate	4.00
Toluene	37.54
Methylethyl ketone	37.54

[1]Polyester resin prepared by using ethylene modified and propylene modified bisphenol A, terephthalic acid and isophthalic acid as raw materials; a molecular weight of 123,000; a softening point of 121 to 128°C.

[2]A softening point of 142°C; a glass transition point of 47°C.

A solution containing polyester resin as a main component was prepared according to the composition shown in Table 1. Then, the resin solution was coated on one surface of a transparent polyethylene terephthalate film having a thickness of 125 μm, by using Meyer bar in an amount to form a dry film of 4 g/m^2. The coated solution was dried by holding for 3 minutes at 65°C and an image-receiving layer was formed. The image-receiving layer had a thickness of 2 to 3 μm , a storage elasticity (G') of 7×10^3 $dyne/cm^2$ and a loss modulus (G") of 2×10^4 $dyne/cm^2$.

On a surface of the image-receiving layer of the image-recording transparent film obtained, a color image was formed by using the electrophotographic system imaging equipment (available from Canon Corp. as "CLC350"). Lightness (L*) and saturation (C*) of the color image of the imaged film obtained were measured in the transmission mode of 10° view field by using a color analyzer "TC-1800MKII" available from Tokyo Denshoku Company. Table 2 shows the results.

Comparative Example 1

An imaged film was prepared and evaluated according to substantially the same manner as described in example 1, except for omitting tricresyl phosphate. The

resulting image-receiving layer had a storage elasticity (G') of 2×10^4 dyne/cm^2 and a loss modulus (G") of 5×10^4 dyne/cm^2. Table 2 shows the results.

Table 2

Color	O.D.[1]	Example 1		Example 2	
		L*	C*	L*	C*
Yellow	0.26	92.93	32.05	86.72	29.35
Magenta	0.17	86.71	14.87	83.09	14.00
Cyan	0.27	85.81	19.75	79.47	18.99

[1]Transparent value

The results of table 2 show that a color image having excellent lightness (L*) and saturation (C*) is obtained by including the plasticizer to the image-receiving layer.

Example 2

Table 3

Composition	Parts by Weight
Polyester resin (available from Reichhold Chemicals Co. as "Atlac 382E")[1]	20.00
Polyester resin (available from Shell Chemical Co. as "VITEL 2700")[2]	0.40
Antistatic agent (available from American Cyanamid Co. as "Cyastat 609")	0.20
Silica particles (available from Fuji Silica Chemical K.K. "Silica 470")	0.03
Tricresyl phosphate	4.00
Toluene	37.69
Methylethyl ketone	37.69

[1]Polyester resin prepared by using propylene modified bisphenol A and fumaric acid as raw materials; a molecular weight of 14,470; a softening point of 94 to 108°C.

[2] A softening point of 142°C; a glass transition point of 47°C.

An imaged film was prepared and evaluated according to substantially the same manner as described in example 1, except for using the composition shown in Table 3. Table 4 shows the results.

Comparative Example 2

An imaged film was prepared and evaluated according to substantially the same manner as described in example 2, except for omitting tricresyl phosphate. Table 4 shows the results.

Table 4

Color	O.D.[1]	Example 2		C. Example 2	
		L*	C*	L*	C*
Yellow	0.22	92.14	27.29	89.76	25.46
Magenta	0.17	85.86	14.25	85.16	11.47
Cyan	0.27	85.32	20.16	83.98	17.18

[1]Transparent value

The results of table 4 show that a color image having excellent lightness (L*) and saturation (C*) is obtained by including the plasticizer to the image-receiving layer.

Example 3

Table 5

Composition	Parts by Weight
Polyester resin (available from Reichhold Chemicals Co. as "Atlac 363E")[1]	20.00
Polyester resin (available from Shell Chemical Co. as "VITEL 2700")[2]	0.40
Antistatic agent (available from American Cyanamid Co. as "Cyastat 609")	0.50
Silica particles (available from Fuji Silica Chemical K.K. "Silica 470")	0.03
Diethylene glycol dibenzoate (available from Sanyo Kasei K.K. as "EB 200")	4.00
Toluene	37.54
Methylethyl ketone	37.54

[1]Polyester resin prepared by using propylene modified bisphenol A and fumaric acid as raw materials; a molecular weight of 66,300; a softening point of 108 to 124°C.

[2]A softening point of 142°C; a glass transition point of 47°C.

An imaged film was prepared and evaluated according to substantially the same manner as described in example 1, except for using the composition shown in Table 5. Table 6 shows the results.

Comparative Example 3

An imaged film was prepared and evaluated according to substantially the same manner as described in example 3, except for omitting tricresyl phosphate. Table 6 shows the results.

Table 6

		Example 3		C. Example 3	
Color	O.D.[1]	L*	C*	L*	C*
Yellow	0.23	92.88	27.54	90.40	26.30
Magenta	0.17	86.45	15.96	85.39	12.80
Cyan	0.25	85.96	19.88	83.76	17.21

[1]Transparent value

The results of table 6 show that a color image having excellent lightness (L*) and saturation (C*) is obtained by including the plasticizer to the image-receiving layer.

Example 4

Table 7

Composition	Parts by Weight
Polyester resin (available from Kao Corp. as "PS-3")[1]	20.00
Polyester resin (available from Shell Chemical Co. as "VITEL 2700")[2]	0.40
Antistatic agent (available from American Cyanamid Co. as "Cyastat 609")	0.20
Silica particles (available from Fuji Silicia Chemical K.K. "Sailicia 470")	0.03
Dioctyl phthalate	4.00
Toluene	37.69
Methylethyl ketone	37.69

[1]Polyester resin prepared by using ethylene modified and propylene modified bisphenol A, terephthalic acid and isophthalic acid as raw materials; a molecular weight of 123,000; a softening point of 121 to 128°C.

[2]A softening point of 142°C; a glass transition point of 47°C.

An imaged film was prepared and evaluated according to substantially the same manner as described in example 1, except for using the composition shown in Table 7. Table 8 shows the results.

Table 8

		Example 4	
Color	O.D.[1]	L*	C*
Yellow	0.26	91.60	32.02
Magenta	0.17	86.29	14.65
Cyan	0.27	84.16	19.63

[1]Transparent value

Example 5

Table 9

Composition	Parts by Weight
Polyester resin (available from Kao Corp. as "PS-3")[1]	20.00
Polyester resin (available from Shell Chemical Co. as "VITEL 2700")[2]	0.40
Antistatic agent (available from American Cyanamid Co. as "Cyastat 609")	0.40
Silica particles (available from Fuji Silicia Chemical K.K. "Sailicia 470")	0.03
Polytetramethylene ether glycol (available from Mitsubisi Kasei K.K. as "PTMG 1000")[3]	4.00
Toluene	37.59
Methylethyl ketone	37.59

[1]Polyester resin prepared by using ethylene modified and propylene modified bisphenol A., terephthalic acid and isophthalic acid as raw materials; a molecular weight of 123,000; a softening point of 121 to 128°C.

[2]A softening point of 142°C; a glass transition point of 47°C.

[3]A molecular weight of 1000.

An image-receiving layer was formed on one surface of the polyethylene terephthalate film according to substantially the same manner as described in example 1, except for using the composition shown in Table 9. The image-receiving layer had a storage elasticity (G') of 5×10^3 dyne/cm^2 and a loss modulus (G") of 2×10^4 dyne/cm^2. The resulting imaged film was evaluated according to substantially the same manner as described in example 1. Table 10 shows the results.

Comparative Example 4

An image-receiving layer was formed on one surface of the polyethylene terephthalate film according to substantially the same manner as described in example 5, except for omitting polytetramethylene ether glycol. The image-receiving layer had a storage elasticity (G') of 2×10^4 dyne/cm^2 and a loss modulus (G") of 5×10^4 dyne/cm^2. The resulting imaged film was evaluated according to substantially the same manner as described in example 5. Table 10 shows the results.

Table 10

Color	O.D.[1]	Example 5		C. Example 4	
		L*	C*	L*	C*
Yellow	0.19	92.47	22.51	86.36	21.67
Magenta	0.13	88.16	11.21	84.67	7.81
Cyan	0.20	86.69	14.64	80.95	13.64

[1]Transparent value

The results of table 10 show that a color image having excellent lightness (L*) and saturation (C*) is obtained by including polyalkylene oxide polyol to the image-receiving layer as the plasticizer.

Example 6

Table 11

Composition	Parts by Weight
Polyester resin (available from Kao Corp. as "PS-3")[1]	20.00
Polyester resin (available from Shell Chemical Co. as "VITEL 2700")[2]	0.40
Antistatic agent (available from American Cyanamid Co. as "Cyastat 609")	0.40
Silica particles (available from Fuji Silicia Chemical K.K. "Sailicia 470")	0.03
Polytetramethylene ether glycol (available from Sanyo Kasei K.K. as "PTMG 650")[3]	4.00
Toluene	37.59
methylethyl ketone	37.59

[1]Polyester resin prepared by using ethylene modified and propylene modified bisphenol A, terephthalic acid and isophthalic acid as raw materials; a molecular weight of 123,000; a softening point of 121 to 128°C.

[2]A softening point of 142°C; a glass transition point of 47°C.

[3]A molecular weight of 650

An image-receiving layer was formed on one surface of the polyethylene terephthalate film according to substantially the same manner as described in example 1, except for using the composition shown in Table 11. The image-receiving layer had a storage elasticity (G') of 3×10^3 dyne/cm^2 and a loss modulus (G") of 1×10^4

dyne/cm^2. The resulting imaged film was evaluated according to substantially the same manner as described in example 1. Table 14 shows the results.

Example 7

Table 12

Composition	Parts by Weight
Polyester resin (available from Kao Corp. as "PS-3")[1]	20.00
Polyester resin (available from Shell Chemical Co. as "VITEL 2700")[2]	0.40
Antistatic agent (available from American Cyanamid Co. as "Cyastat 609")	0.40
Silica particles (available from Fuji Silicia Chemical K.K. "Sailicia 470")	0.03
Polypropylene glycol (available from Sanyo Kasei K.K. as "PP 400")[3]	4.00
Toluene	37.59
Methylethyl ketone	37.59

[1]Polyester resin prepared by using ethylene modified and propylene modified bisphenol A, terephthalic acid and isophthalic acid as raw materials; a molecular weight of 123,000; a softening point.of 121 to 128°C.

[2]A softening point of 142°C; a glass transition point of 47°C.

[3]A molecular weight of 400

An image-receiving layer was formed on one surface of the polyethylene terephthalate film according to substantially the same manner as described in example 1, except for using the composition shown in Table 12. The image-receiving layer had a storage elasticity (G') of 2 x 10^3 dyne/cm^2 and a loss modulus (G") of 8 x 10^3 dyne/cm^2. The resulting imaged film was evaluated according to substantially the same manner as described in example 1. Table 14 shows the results.

Example 8

Table 13

Composition	Parts by Weight
Polyester resin (available from Kao Corp. as "PS-3")[1]	20.00
Polyester resin (available from Shell Chemical Co. as "VITEL 2700")[2]	0.40
Antistatic agent (available from American Cyanamid Co. as "Cyastat 609")	0.40
Silica particles (available from Fuji Silicia Chemical K.K. "Sailicia 470")	0.03
Polyalkylene glycol (available from Sanyo Kasei K.K. as "GP 250")[3]	4.00
Toluene	37.59
Methylethyl ketone	37.59

[1]Polyester resin prepared by using ethylene modified and propylene modified bisphenol A, terephthalic acid and isophthalic acid as raw materials; a molecular weight of 123,000; a softening point of 121 to 128°C.

[2]A softening point of 142°C; a glass transition point of 47°C.

[3]A molecular weight of 250

An image-receiving layer was formed on one surface of the polyethylene terephthalate film according to substantially the same manner as described in example 1, except for using the composition shown in Table 13. The image-receiving layer had a storage elasticity (G') of 5×10^3 dyne/cm^2 and a loss modulus (G") of 2×10^4 dyne/cm^2. The resulting imaged film was evaluated according to substantially the same manner as described in example 1. Table 14 shows the results.

Table 14

		Example 6		Example 7		Example 8	
Color	O.D.[1]	L*	C*	L*	C*	L*	C*
Yellow	0.19	93.01	22.43	93.49	22.51	93.45	23.21
Magenta	0.13	88.23	11.20	87.35	13.47	87.58	13.03
Cyan	0.20	87.30	15.61	87.25	15.79	87.76	15.40

[1]Transparent value

The results of table 14 show that a color image having excellent lightness (L*) and saturation (C*) is obtained by including polyalkylene oxide polyol to the image-receiving layer as the plasticizer.

Example 9

Table 15

Composition	Parts by Weight
Polyester resin (available from Reichhold Chemicals Co. as "Atlac 363E")[1]	20.00
Polyester resin (available from Shell Chemical Co. as "VITEL 2700")[2]	0.40
Antistatic agent (available from American Cyanamid Co. as "Cyastat 609")	0.20
Silica particles (available from Fuji Silicia Chemical K.K. "Sailicia 470")	0.03
Polyethylene glycol (available from Sanyo Kasei K.K. as "PEG 200")[3]	4.00
Toluene	37.69
Methylethyl ketone	37.69

[1]Polyester resin prepared by using propylene modified bisphenol A and fumaric acid as raw materials; a molecular weight of 66,300; a softening point of 108 to 124°C.

[2]A softening point of 142°C; a glass transition point of 47°C.

[3]A number average molecular weight of 200

An image-receiving layer was formed on one surface of the polyethylene terephthalate film according to substantially the same manner as described in example 1, except for using the composition shown in Table 15. The image-receiving layer had a storage elasticity (G') of 3×10^2 dyne/cm^2 and a loss modulus (G") of 3×10^3 dyne/cm^2. The resulting imaged film was evaluated according to substantially the same manner as described in example 1. Table 16 shows the results.

Comparative Example 5

An image-receiving layer was formed on one surface of the polyethylene terephthalate film according to substantially the same manner as described in example 9, except for omitting polyethylene glycol. The image-receiving layer had a storage elasticity (G') of 2×10^3 dyne/cm^2 and a loss modulus (G") of 2×10^4 dyne/cm^2. The resulting imaged film was evaluated according to substantially the same manner as described in example 9. Table 16 shows the results.

Table 16

Color	O.D.[1]	Example 9		C. Example 5	
		L*	C*	L*	C*
Yellow	0.22	93.09	30.98	90.17	28.23
Magenta	0.14	97.79	12.41	86.84	10.95
Cyan	0.22	87.21	18.29	84.64	16.08

[1]Transparent value

The results of table 16 show that a color image having excellent lightness (L*) and saturation (C*) is obtained by including polyalkylene oxide polyol to the image-receiving layer as the plasticizer.

Example 10

Table 17

Composition	Parts by Weight
Polyester resin (available from Reichhold Chemicals Co. as Atlac 382E")[1]	20.00
Polyester resin (available from Shell Chemical Co. as "VITEL 2700")[2]	0.40
Antistatic agent (available from American Cyanamid Co. as "Cyastat 609")	0.20
Silica particles (available from Fuji Silicia Chemical K.K. "Sailicia 470")	0.03
Polyalkylene glycol (available from Sanyo Kasei K.K. as "GP 25011)[3]	4.00
Toluene	37.69
Methylethyl ketone	37.69

[1]Polyester resin prepared by using propylene modified bisphenol A and fumaric acid as raw materials; a molecular weight of 14,470; a softening point of 94 to 108°C.

[2]A softening point of 142°C; a glass transition point of 47°C.

[3]A number average molecular weight of 250

An image-receiving layer was formed on one surface of the polyethylene terephthalate film according to substantially the same manner as described in example 1, except for using the composition shown in Table 17. The image-receiving layer had a storage elasticity (G') of 2×10^3 dyne/cm^2 and a loss modulus (G") of 8×10^2 dyne/cm^2. The resulting imaged film was evaluated according to substantially the same manner as described in example 1. Table 18 shows the results.

Comparative Example 6

An image-receiving layer was formed on one surface of the polyethylene terephthalate film according to substantially the same manner as described in example 10, except for omitting polyalkylene glycol. The image-receiving layer had a storage elasticity (G') of 1×10^2 dyne/cm^2 and a loss modulus (G") of 3×10^3 dyne/cm^2. The resulting imaged film was evaluated according to substantially the same manner as described in example 10. Table 18 shows the results.

Table 18

Color	O.D.[1]	Example 10		C. Example 6	
		L*	C*	L*	C*
Yellow	0.22	93.25	28.15	92.18	27.59
Magenta	0.14	88.47	11.73	88.13	11.68
Cyan	0.22	97.96	17.13	86.07	17.06

[1]Transparent value

The results of table 18 show that a color image having excellent lightness (L*) and saturation (C*) is obtained by including polyalkylene oxide polyol to the image-receiving layer as the plasticizer.

Technical Effects of the Invention:

An image-recording transparent film which can record a transparent image by the use of an electrophotographic recording system, wherein the transparent image has high lightness and saturation and offers good color tone reproducibility in the use for OHP is provided.

Brief Explanation of Drawings:

Fig. 1: A cross-sectional view which illustrates one embodiment of the present image-recording transparent film.

Fig. 2: A cross-sectional view which illustrates one aspect of using the present image-recording transparent film.

Explanation of Numbering:

100	Image-recording transparent film,
101	Film substrate,
102	Image-receiving layer,
200	Image-recording transparent film,
203	Imaging material,
205	Imaging material layer,
206	Imaged film.

Claims:

1. An image-recording transparent film comprising a light-transmitting film substrate and a light-transmitting image-receiving layer placed on at least one major surface of the film substrate,

wherein said image-receiving layer contains (a) a thermoplastic resin selected from the group consisting of a polyester resin, a styrene/acrylic resin, an acrylic resin, an epoxy resin, an urethane resin and a polyolefin resin, and (b) a plasticizer selected from the group consisting of (i) the plasticizer having at least one aromatic ring in its molecule and (ii) polyalkylene oxide polyol.

2. The image-recording transparent film according to claim 1, wherein the image-receiving layer contains 100 parts by weight of the thermoplastic resin and from 1 to 50 parts by weight of the plasticizer.

3. The image-recording transparent film according to claim 1, wherein the image-receiving layer has a storage elasticity of from 1×10^1 to 1×10^5.

4. An imaged film comprising the image-recording transparent film according to any one of claims 1 to 3 and an imaging material layer which is imagewise placed on a surface of the image-receiving layer thereof.

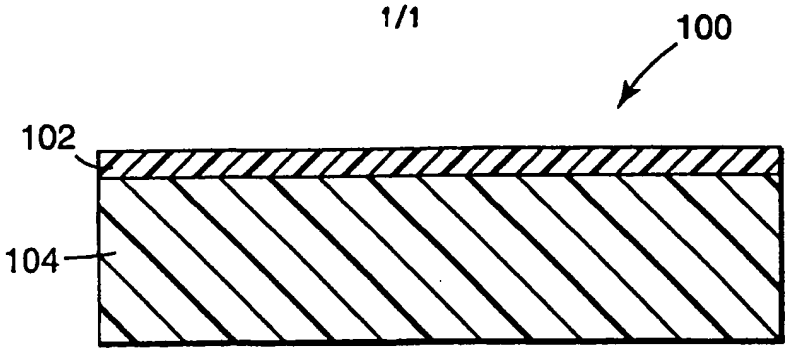

Fig.1

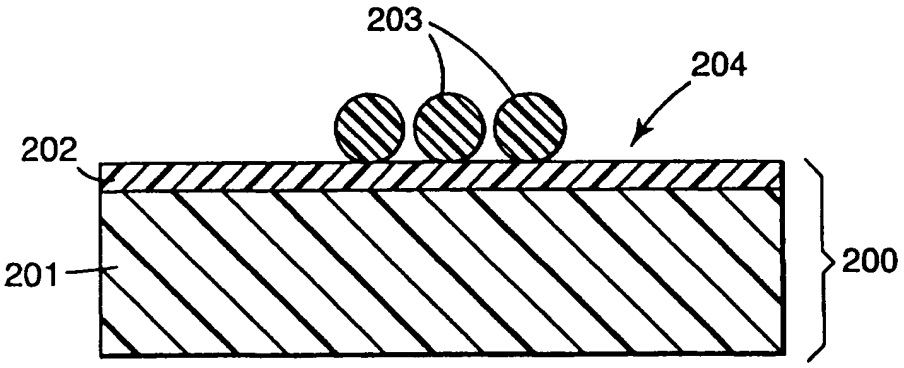

Fig.2a

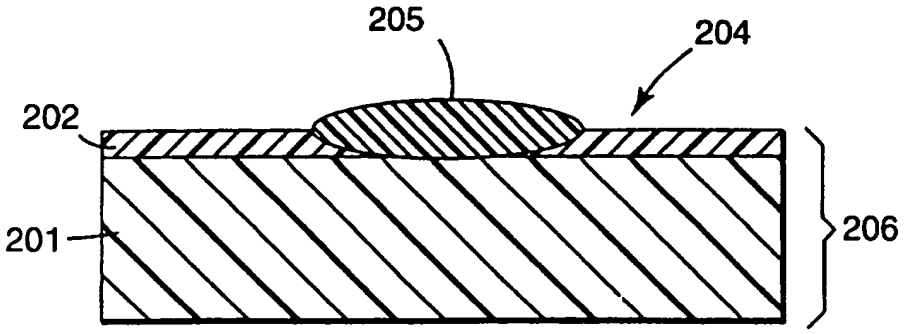

Fig.2b

INTERNATIONAL SEARCH REPORT

Inten ıal Application No
PCT/US 96/18524

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G03G7/00 B41M5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G03G B41M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 22 29 517 A (XEROX CORP) 28 December 1972	1,2,4
Y	see page 11; example 2	3
Y	EP 0 349 227 A (CANON KK) 3 January 1990 see claims 1,6,7	3
X	EP 0 523 511 A (AGFA GEVAERT AG) 20 January 1993 see page 5, line 1 - line 8 see page 5, line 15 - line 16 see page 5, line 21 - line 23; claims 1-5	1,2,4
X	US 5 006 407 A (MALHOTRA SHADI L) 9 April 1991 see claims 1,2,4	1,2,4

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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1

Date of the actual completion of the international search	Date of mailing of the international search report
14 March 1997	18. 04. 97

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INTERNATIONAL SEARCH REPORT

Inten ial Application No
PCT/US 96/18524

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 849 286 A (MILNE MARJORIE H) 18 July 1989 see column 4; claim 10; example 1	1,2,4
X	EP 0 674 232 A (XEROX CORP) 27 September 1995 see page 10; claim 1; example 4	1,2,4

1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern ıal Application No
PCT/US 96/18524

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2229517 A	28-12-72	AR 193996 A	12-06-73
		CA 985583 A	16-03-76
		GB 1390137 A	09-04-75
		NL 7208463 A	27-12-72
		US 3736133 A	29-05-73
EP 0349227 A	03-01-90	JP 2263642 A	26-10-90
		DE 68927141 D	17-10-96
		DE 68927141 T	06-02-97
		FR 2633738 A	05-01-90
		US 5032440 A	16-07-91
		US 5009945 A	23-04-91
		US 5229188 A	20-07-93
		US 5352553 A	04-10-94
EP 0523511 A	20-01-93	DE 4123919 A	21-01-93
		DE 59203729 D	26-10-95
		JP 5193276 A	03-08-93
		US 5317000 A	31-05-94
US 5006407 A	09-04-91	JP 2270589 A	05-11-90
		US 5118570 A	02-06-92
US 4849286 A	18-07-89	NONE	
EP 0674232 A	27-09-95	US 5451466 A	19-09-95
		JP 7261416 A	13-10-95